CLAIMS

1. A method for checking the position of a mechanical part **(2)** along at least one checking direction **(X)** by means of an apparatus **(1)** including a device **(6)** for generating a light beam **(7)** along a trajectory **(Y)** transversal to said checking direction **(X)**, a sensor **(8)** for detecting the interruption of the light beam **(7)**, and devices **(3)** for causing mutual displacements between the mechanical part **(2)** and the light beam **(7)** along said checking direction **(X)** and along an inspection direction **(Z)** transversal to the checking direction **(X)**, the method including the following steps:

- identifying **(19)** a first linear interval **(X1)** and a second linear interval **(Z1)** of the mutual positions between mechanical part **(2)** and light beam **(7)** along the checking direction **(X)** and, respectively, the inspection direction **(Z)**, said first linear interval **(X1)** and said second linear interval **(Z1)** defining a checking area **(13)** of the mechanical part **(2)**,
- controlling a sequence of checking displacements between mechanical part **(2)** and light beam **(7)**, including
  - displacements **(29)** for bringing the light beam **(7)** to inspection positions **(Pi;P1-P4)** of the first linear interval **(X1)**, and
  - at said inspection positions **(Pi;P1-P4)**, linear inspection movements **(30)** along said inspection direction **(Z)**,
- detecting **(31-34)** the interruption or the non-interruption of the light beam **(7)** in the course of said linear inspection movements along the inspection direction **(Z)**, and consequently selecting **(35,36,38)** the subsequent of said inspection positions **(Pi;P1-P4)** of the first linear interval **(X1)** at which the subsequent linear inspection movements are controlled,
- stopping **(37)** the sequence of checking displacements at a final inspection position **(PN)** of the light beam **(7)**

in the first linear interval **(X1)** that lies at a distance **(D)** less than a preset value **(W)** from a previous inspection position **(Pi;P1-P4)**, where, in the course of linear inspection movements at said final inspection position **(PN)** and said previous inspection position **(Pi;P1-P4)** in the first linear interval **(X1)**, there have been detected, respectively, the interruption **(32,34)** and the non-interruption **(31,33)** of the light beam **(7)**, or vice versa, and

- identifying **(41)** the position of the mechanical part **(2)** along the checking direction **(X)** on the basis of said final inspection position **(PN)**.

2. The method according to claim 1, wherein said inspection positions **(Pi;P1-P4)** of the first linear interval **(X1)** are selected at distances **(D)** progressively decreasing from each other according to a convergent sequence.

3. The method according to claim 2, wherein said inspection positions **(Pi;P1-P4)** of the first linear interval **(X1)** are selected at distances **(D)** progressively halved from each other.

4. The method according to claim 2 or claim 3, wherein said displacements **(29)** for bringing the light beam **(7)** to inspection positions **(Pi;P1-P4)** of the first linear interval **(X1)** are controlled in a sense **(V)** or in the opposite sense along said checking direction **(X)** as a consequence **(35)** of the detecting of the interruption **(32,34)** or the non-interruption **(31,33)** of the light beam **(7)** in the course of the linear inspection movements at the two most recent inspection positions **(Pi;P1-P4)**.

5. The method according to one of the preceding claims, including a preliminary verification phase of said checking area **(13)** with displacements between light beam **(7)** and

mechanical part **(2)** between predetermined points **(14,15,16,17)** of the checking area **(13)**.

6. The method according to claim 5, wherein said preliminary verification phase includes at least one of said linear inspection movements along the inspection direction **(Z)**.

7. The method according to one of the preceding claims, wherein said linear inspection movements along said inspection direction **(Z)** are interrupted as soon as the interruption of the light beam **(7)** is detected **(32)**.

8. The method according to one of the preceding claims, wherein the trajectory **(Y)** of said light beam **(7)** and said checking area **(13)** are substantially perpendicular.

9. The method according to one of the preceding claims, wherein in the step of stopping **(37)** the sequence of the checking displacements, said previous inspection position **(Pi;P1-P4)** is the immediately preceding position with respect to the final inspection position **(PN)**.

10. The method according to one of the preceding claims, wherein said light beam is a laser beam **(7)**.

11. A method for checking the position of a mechanical part **(2)** along at least one checking direction **(X)** by means of an apparatus **(1)** including a device **(6)** for generating a light beam **(7)** along a trajectory **(Y)** transversal to said checking direction **(X)**, a sensor **(8)** for detecting the interruption of the light beam **(7)**, and devices **(3)** for causing mutual displacements between the mechanical part **(2)** and the light beam **(7)** along said checking direction **(X)** and along an inspection direction **(Z)** transversal to said checking direction **(X)**, the method including the following steps:

- identifying **(19)** a first linear interval **(X1)** and a second linear interval **(Z1)** of the mutual positions between mechanical part **(2)** and light beam **(7)** along the checking direction **(X)** and, respectively, the inspection direction **(Z)**, said first linear interval **(X1)** and said second linear interval **(Z1)** defining a checking area **(13)** of the mechanical part **(2)**,
- controlling the following sequence of checking displacements between mechanical part **(2)** and light beam **(7)**
  - (a) a linear inspection movement **(30)** along said inspection direction **(Z)** within the checking area **(13)**, till there occurs one of the following events
    - (i) interruption **(32,34)** of the light beam **(7)**, or
    - (ii) covering **(31,33)** of the entire second linear interval **(Z1)** with no interruptions of the light beam **(7)**,
  - (b) a displacement **(29)** along the checking direction **(X)**, in a determined sense **(V)**, up to an inspection position **(Pi;P1-P4)** of the light beam **(7)** in said first linear interval **(X1)**,
  - (c) the repetition of the linear inspection movement **(30)** along the inspection direction **(Z)** according to step (a),
  - (d) a fresh displacement **(29)** along the checking direction **(X)** in the sense **(V)** of the previous displacement, or in the opposite sense, according to **(35)** whether the event (i) or (ii) that occurred **(31-34)** in the most recent linear inspection movement **(30)** be or not be the same that occurred in the previous linear inspection movement **(30)**, up to a fresh inspection position **(Pi;P1-P4)** of the light beam **(7)** in said first linear interval **(X1)**, at a known distance **(D)** with respect to the immediately previous

inspection position **(Pi;P1-P4)**,

(e) the repetition of linear inspection movements and displacements, according to steps (c) and (d) - with progressively decreasing distances **(D)** between the fresh inspection positions **(Pi;P1-P4)** and the immediately previous inspection positions **(Pi;P1-P4)** of the light beam **(7)** in said first linear interval **(X1)** - till **(35,37)** the distance **(D)** between the fresh inspection position **(Pi,PN;P1-P4)** and a previous inspection position **(Pi;P1-P4)** - at which the linear inspection movement causes the occurring of one of the events (i) and (ii) and, respectively, the opposite event - is less than a prefixed value **(W)**, and

- identifying **(41)** the position of the mechanical part **(2)** along the checking direction **(X)** on the basis of the fresh inspection position **(PN)** of the light beam **(7)** in said first linear interval **(X1)** at the end of the sequence of checking displacements.

12. The method according to one of the preceding claims, for checking the position of a working area **(11,12)** of a tool **(2)** coupled to the turret **(3)** of a machine tool **(4)**.

13. A system for checking the position of a working area **(11,12)** of a tool **(2)** coupled to the turret **(3)** of a machine tool **(4)**, wherein said machine tool includes a control unit **(10)** for controlling the steps of a method according to claim 12.